Call establishment method

Technical Field:

The invention relates to a method for establishing a communication connection between a calling subscriber terminal and a called subscriber terminal connected to a communication network. Furthermore, the invention is based on a terminal for a communication network, the terminal comprising a first function element for establishing circuit switched connections to called subscriber terminals over the communication network and a server for the provisioning of services to calling subscriber terminals connected over a communication network with called subscriber terminals.
The invention is based on a priority application EP 02 360 313.7 which is hereby incorporated by reference.

Background of the Invention:

The invention relates to a method for establishing a communication connection between a calling subscriber terminal and a called subscriber terminal. Further, the invention relates to a terminal for a communication network, wherein the terminal comprises a first function element for establishing circuit switched connections to called subscriber terminals over the communication network. Further, the invention relates to a server for the provisioning of services to calling subscriber terminals of a communication network, wherein the calling subscriber terminals are connected over the communication network with called subscriber terminals.

Today, different addressing mechanisms are used for IP telephony, also known as Voice over Internet Protocol (VoIP), and for classical PSTN telephony (PSTN= Public Switched Telephone Network).

For PSTN telephony, E.164 numbers are used.

IP telephony uses the internet protocol to transmit voice packets over an IP network. There are two competing standardised protocols for VoIP operations, ITU-T H.323 and IETF Session Initiation Protocol (SIP). These two protocols describe the signalling and the control of multimedia conferences over packet based networks by different ways. Further, there is following way to resolve an address in an IP network: A domain name server is used to translate an input uniform resource locator or uniform resource identifier into an IP address. The domain name servers are arranged in a hierarchical structure. If a domain name server receives an address query that it cannot resolve, it will typically return the address of a higher level domain name server that may be able to resolve the address or forward the query to this higher level domain name server.

With introduction of IP telephony it becomes necessary that calls originating in a PSTN network and destined for an IP subscriber must be translated from the E.164 number entered by the PSTN subscriber to an IP address that is usable in the IP network. A gateway function between the PSTN network and the IP network performs a protocol translation such as translation from Session Initiation Protocol (SIP) to Integrated Services User Part (=ISUP in the Signaling System 7). The gateway function performs a media conversion from packet-switched to circuit-switched transport protocols. Translating an E.164 number requires locating an appropriate gateway. This is not a simple address translation with global relevance, because each operator prefers to choose a gateway based on the operators local policy.

An alternative method for translating E.164 numbers into IP addresses is proposed by the ENUM Internet Engineering Task Force (EETF) working group. This method uses the domain name server infrastructure to perform the address resolution, by supplying it with the E. 164 number converted into a DNS name. For example, the E.164 number 045678 may be converted to the domain name 8.7.6.5.4.0. . Since the domain name infrastructure is used, the address translation has a global relevance.

Consequently, an IP telephony subscriber can be addressed through a URL/URI or an E.164 number (URL = Uniform Resource Locator; URI= Uniform Resource Identifier). In contrast to this, a PSTN subscriber has to be addressed by an E.164 number.

Summary of the Invention:

It is an object of the present invention to improve present call establishment methods.

The object of the present invention is achieved by a method for establishing a communication connection between a calling subscriber terminal and a called subscriber terminal connected to a circuit switched network, wherein the method comprises the steps of: entering, at the calling subscriber terminal, a request to access the called subscriber terminal; transferring an identification of the called subscriber to a mediation function element; transmitting said identification of the called subscriber from the mediation function element to an address translation server; transmitting a circuit switched network address of a terminal of the called subscriber from the address translation server to the mediation function element; and initiating a call establishment by passing said address from the mediation function element to a call handling function of the circuit switched network. The object of the present invention is further achieved by a terminal for a communication network, the terminal comprises: a first function element for establishing circuit switched connection to called subscriber terminals over the communication network; a second function element for receiving a request to access one or several called subscribers and for transferring an identification of a called subscriber to a mediation function element; and a mediation function element for receiving the identification of the called subscriber from the second function element, transmitting said identification to the called subscriber from the mediation function element to an address translation server, receiving from the address translation server a circuit switched network address of a terminal of the called subscriber, and initiating a call establishment by passing that address through the first function element to a call handling function of the circuit switched network. The object of

the present invention is further achieved by a server for the provisioning of services to calling subscriber terminals of a circuit switched communication network, the calling subscriber terminals connected over the circuit switched communication network with called subscriber terminals, wherein the server comprises at least one mediation function element for: receiving requests from calling subscriber terminals, the requests transmitting at least one identification of a called subscriber from a subscriber terminal to the mediation function element; transmitting the identification of the called subscriber to an address translation server; receiving from the address translation server a circuit switched network address of a terminal of the called subscriber; and initiating a call establishment by passing that circuit switched network address to a call handling function of the circuit switched communication network.

Several advantages are achieved by the invention:

A comfortable user interface is provided to users of traditional telephone services. It becomes possible to introduce IP services while maintaining traditional circuit switched calls. It provides an efficient, cost-saving and powerful architecture to keep the attractions of classical circuit switched connections in the world of IP services.

Further advantages are achieved by the embodiments indicated by the dependent claims.

According to an preferred embodiment of the invention, the mediation function element is adapted for: receiving from the address translation server a list of associated service identifications returned from the address translation server on the transmission of the identification; receiving a selection command from

the second function element selecting one of the service identifications; and sending a corresponding selection command to the address translation server which returns the switched network address of the called subscriber terminal. This functionality improves the user-friendiness of the system. It becomes for example possible to select a terminal out of a descriptive list of terminals, which makes it easier for the user to access the right terminal.

A terminal preferably has following architecture: the first function element is adapted for controlling circuit switched based services, the second function element is adapted for controlling IP based services and the mediation function element is adapted for mediating between IP based services and circuit switched based services. This kind of architecture ensures proper and efficient interaction between IP based services and circuited switched based services implemented in the same terminal. Further, the IP based user interface can be used to control circuit switched based services. This allows providing a powerful user interface for both, for IP based services and for circuit switched based services. Further, already developed function blocks can be reused, which results in cost-savings.

Further, following detailed architecture is proposed.

The second function element contains a function platform and one or several service applications interacting with the function platform via a first common API. The mediation function element interacts via the first common API with the function platform and via a second API with the first function element. The function platform may comprise a browser providing a graphical user interface. Further, the function platform may comprise means for providing a packet based data transfer service, for example a GPRS service (GPRS= General

Packet Radio Service). This kind of architecture improves the interaction between IP based services and circuit switched based services and lowers the efforts for the development of service applications. Classical circuit switched based services may be addressed in the framework of this platform which lowers investments, increase the possibilities to create new services and increases the flexibility of the whole system.

According to a preferred embodiment of the invention, the terminal is a mobile phone supporting WEB-based services of the packet switch domain and circuit switch based services of the circuit domain. Preferably, the mobile phone has GPRS capability which is used for IP-based services. A further preferred form of terminal is an fixed network terminal (e. g. an ISDN terminal, an DSL terminal or a WEB-phone).

Brief Description of the Drawings:

These as well as other features and advantages of the invention will be better appreciated by reading the following detailed description of presently preferred exemplary embodiments taken in a conjunction with accompanying drawings of which:

Fig. 1 is a block diagram which shows a communication system comprising a terminal according to the invention.

Fig. 2 is a block diagram which shows a communication system comprising a server according to the present invention.

Detailed Description of Pr ferred Embodiments:

Fig. 1 shows two communication networks 1 and 2, several subscriber terminals 4, 61, 62 and 63, and a server 7. The terminals 4 and 62 are associated to subscribers 91 and 92, respectively.

The communication network 1 is a traditional circuit switched communication network. For example, the communication network 1 is formed by one or several mobile communication networks and one or several fixed communication networks assigned to different network operators. The mobile communication networks are, for example, GSM networks or UMTS networks (GSM= Global System for Mobile Communication; UMTS= Universal Mobile Telecommunications System). The fixed communication networks are for example ISDN networks or PSTN networks (ISDN= Integrated Services Digital Network; PSTN = Public Switched Telecommunication Network).

But, it is also possible that the communication network 1 does only contain a single fixed communication network or a single mobile communication network.

According to a preferred embodiment of the invention, the communication network offers to subscriber terminals in addition to circuit switched communication services also packet based data transfer services. For example, the communication network 1 is a GSM network which offers beside the traditional phone communication service a GPRS service (GPRS = General Packet Radio Service). The GPRS service enables the transfer of packet based data traffic over the air interface.

The communication network 2 is a packet based data network. According to a preferred embodiment of the invention, the communication network 2 is an IP-

network (IP = Internet Protocol). This kind of networks uses the so-called IP protocol as level 3 protocol. For example, the communication network 2 is constituted by several interconnected physical networks using ATM or ETHERNET protocols as MAC protocols (ATM = Asynchronous Transfer Mode; MAC = Media Access Control) and the TCP/IP protocol stack as higher level protocols. The communication network 2 may be the Internet.

The communication network 1 comprises a plurality of exchanges interconnecting the subscriber terminals connected with the communication network 1. Figure 1 shows three exchanges 12, 13 and 14. Further, the communication network 1 comprises one or several gateways which enable an interconnection between the communication networks 1 and 2. Figure 1 shows a gateway 11, which performs gateway functionalities for a packet based data transfer service offered by the communication network 1 to subscriber terminals. For example, the gateway 11 routs packets, which exchanged via the GPRS service with subscriber terminals of the communication network 1, to the communication network 2.

But, it is also possible that the gateway 11 is formed by an internet access gateway providing internet access services for dialed up circuit switched connections or for data traffic exchanged via ADSL, DSL, SDSL or SHDSL services (ADSL = Asynchronous Digital Subscriber Line; DSL = Digital Subscriber Line; SDSL = Symmetrical Single-Pair High-Bitrate Digital Subscriber Line; SHDSL = Single-Pair High–Speed Digital Subscriber Line). Dial up connections may base on ISDN or POT network access services (POT = Plain Old Telephone).

The terminals 4, 61 and 62 are mobile phones. The terminal 63 is a fixed telephone set.

The terminal 4 is a GSM mobile phone with GPRS capability. It is formed by an electronic circuit comprising one or several microprocessors and an high frequency radio part, an antenna, a battery pack, and input and output means, for example a keyboard, a TFT display (TFT = Thin Film Transistor), a microphone, a loudspeaker, and a digital camera. Further, the terminal 4 comprises a plurality of application programs executed by the one or several microprocessors of the hardware platform of the terminal 4. The functions of the terminal 4 are mainly provided by the execution of these software programs on the hardware platform of the terminal 4.

From functional point of view, terminal 4 comprises an input/output unit 41, two functional elements 42 and 44 and a mediation function element 40.

The input/output means 41 are formed by the above described input/output means (keyboard, display...) and the associated hardware and software driver elements.

The function element 44 comprises the functionalities for establishing a circuit switched connections to called subscriber terminals of the communication network 1. For example, it comprises all functionalities to handle the GSM telephone service. It exchanges signalling messages (MSC = mobile switching center) for establishing and releasing circuit switched connections with the presently associated MSC via the air interface.

For example, the exchange 12 is the presently associated MSC. The exchange 12 comprising a call handling function 18 responsible for the connection between the terminal 4 and the exchange 12. According to the signaling messages exchanged between the terminal 4 and the exchange 12, the call handling function 18 establishes and releases circuit switched connections connecting the terminal 4 with other subscriber terminals of the communication network 1.

The function element 42 comprises functionalities for exchanging data with the communication network 1via a packet based data transfer service. Further, it comprises functionalities to offer following service. If it receives a specific kind of service request requesting the establishment of a circuit switched connection to one or several called subscribers, it transfers an identification of the called subscriber to the mediation function element 43.

The mediation function element 43 comprises following functionalities.

If it receives the identification of the called subscriber from the function element 42, it transmits the identification of the called subscriber to the addressed translation server 7. This is preferably done by using the packet based data transfer service offered by the function element 42.

Further, it is possible that the mediation function element 43 changes the encoding of the identification, converts the data format of the identification or attach additional information to the identification. For example, it changes the encoding of an identification from a hexa-decimal code to an ASCI code.

When it receives from the address translation server 7 a circuit switched network address of a terminal of the called subscriber, it initiates a call establishment by passing the address through the function element 44 to a call handling function of the communication network 1. For example, the function element 44 sends a signaling message which comprises the circuit switched network address of the terminal 62 to the exchange 12. The signaling message requests the establishment of a circuit switched connection between the terminal 4 and the called subscriber terminal 62 indicated by the circuit switched network address.

According to a preferred embodiment of the invention, the function elements 42 and 44 and the mediation function element 43 have following detail implementation:

The function element 44 comprises all functionalities for controlling circuit switched based services.

The function element 42 comprises all functionalities for controlling IP based services. From functional point of view, it has a function platform 45 and one or several service applications. Fig. 1 shows two service applications 46 and 47 of these service applications. But, it is also possible that the function element 42 does only comprise the function platform 45 and does not comprise any service application.

The service applications 46 and 47 interact with the function platform 45 via an API 49 (API = Application Program Interface). Further, the mediation function 43 interacts with the function platform 45 via the same API, which means over the API 49.

The function platform 45 comprises a browser providing a graphical user interface. Further, the function platform 45 comprises the functions 48, which provides a packet based data transfer service.

For example, the function platform 45 comprises a browser application, for example a WAP browser or a WWW browser (WAP = Wireless Application Protocol; WWW = World Wide Web). This browser application controls the input/output means 41 and provides a graphical user interface 86 to the user 91. The graphical user interface 86 is used to control services offered by the terminal 4. Further, the function platform 45 comprises all the functionalities which offer communication services to the browser application. Through these services, it becomes possible for the browser application to exchange information with terminals and servers connected with the communication network 2.

For example, the TCP/IP protocol stack is used to transfer HTML or XML content (HTML = Hypertext Markup Language; XML = Extended Markup Language) between the browser application of the function platform 45 and interacting applications executed by terminals or servers of the communication network 2. The service applications 46 and 47 are plug-in applications interconnected and controlled by the browser application of the function platform 45.

But, it is also possible that the function platform 45 comprises an engine for executing one or several platform independent programming languages (for example a Java Virtual Machine) and the service applications 46 and 47 are formed by application software encoded in this programming language. Even in

this case, the application services are controlled by the browser application of the function platform 45 via the API 49.

The mediation function element 43 comprises functionalities for mediating between IP based services and circuit switched based services. It interacts via the common API 49 with the function platform 45 and via an API 40 with the function element 44. The mediation function 43 may be a browser plug-in configured for the browser application of the function platform 45. As the other plug-ins 46 and 47, it offers one or several services to other service applications based on the function platform 45. It plays a mediation function role which makes services of the function element 44 visible within the domain of the IP or packet based services.

For example, the service applications 46 and 47 offer a range of mobile IP based services to the subscriber 91. It becomes possible for these service applications to access circuit switched services during service provisioning of IP based services. The mediation function 43 plays the role of a "dummy" SIP plug-in: It provides to the subscriber 91 a SIP kind of service (SIP = Session Initiation Protocol). This service is provided within the framework of a WWW graphical user interface to the subscriber 91.

Further, the function platform offers WAP, IP or WWW communication services to the mediation function 43. These services are used to establish a WAP, IP or WWW connection between the mediation function element 43 and the address translation server 7.

In the following, a preferred embodiment of the invention is described by hand of a "hyperlink with SIP-scheme service" offered by the mediation function element 43.

The function platform 45 displays a HTML page (HTML = Hypertext Markup Language) or an XML page (XML = Extended Markup Language) to the subscriber 91. Beside other kind of information, the page displays a hyperlink identifying the subscriber 92.

For example, the hyperlink has the following form: SIP://maier@alcatel.de.

This hyperlink may have been entered by the subscriber 91 (for example by the keyboard). Further, it is possible that this hyperlink is displayed as part of a HTML page received from one of the service applications 46 or 47 or from a server or terminal of the communication network 2.

The subscriber 91 selects the hyperlink, for example clicks on the hyperlink. The function platform 45 interprets this selection as request to access the called subscriber terminal associated to this hyperlink. The function platform 45 transfers this hyperlink representing an identification of the called subscriber to the mediation function element 43. The mediation function element 43 establishes a WWW connection over the gateway 11 to the server 7 of the communication network 2. It uses the communication service offered by the function platform 45 to establish this connection constituted by a connection 82 between the terminal 4 and the gateway 11 (e. g. GPRS connection) and a connection 83 between the gateway 11 and the server 7 (e. g. IP connection). The gateway 11 checks the internet access rights and properties of the terminal

4. Then, it establishes the connection 83. Now, WWW-messages are exchanged between the mediation function element 43 and the server 7.

The server 7 is an E.164 directory server which translates URL/URI into an associated E.164 number (URL = Uniform Resource Locator; URI = Uniform Resource Identifier).

The mediation function element 43 transmits the identification of the called subscriber, which is the above described hyperlink, over the established WWW connection to the address translation server 7. The server 7 translates this hyperlink into an E.164 number, which is a circuit switched network address. It replies a WWW message containing this E.164 number.

For example, the circuit switched network address is the E.164 number of the terminal 62.

Further, the mediation function element 43 triggers a call establishment function offered by the function element 44 via the API 40. It transfers the received E.164 number to this service of the function element 44. This triggers the function element 44 to send a corresponding signaling message to the exchange 12. This signaling message causes the establishment of a circuit switched connection 80 between the terminal 4 and the terminal 62.

The above described call establishment method may be also applied on hyperlinks according to the scheme proposed by the ENUM Internet Engineering Task Force (IETF working group):

The call establishment is triggered by selecting a "contact", for example by a click pointing to a "contact", instead of a hyperlink. Clicking the contact causes the mediation function element to query the ENUM DNS (DNS = Domain Name Server) which returns all possibilities to contact the identified contact person. The mediation function element 43 displays, via the graphical user interface provided by the function platform 45, all available ways to contact the contact person. For example, it displays following contact on the screen of the terminal 4:

Select:

SIP MM

MAIL...

PHONE-1

PHONE-2

...

The subscriber 91 selects one of these contacts out of the list. In the case of selecting "PHONE-x", the mediation function element accesses the server 7, requests the associated E.164 number and initiates the call establishment by accessing the function element 44 via the API 40 as already described above.

But, it is also possible that the associated E.164 number was already submitted together with the contacts to the mediation function 43. In this case, no further

access to the server 7 is necessary and the mediation function 7 may directly initiate the call establishment by triggering the call establishment function of the function element 44 as described above.

This method makes it possible to alternatively contact somebody via circuit switched calls in the circuit switched domain or SIP based VoIP calls in the packet switched domain.

This scenario also offers the possibility to extend the ENUM service in such a way, that it returns several applicable telephone numbers and than querying just one number. This needs an extension of the URL, for example by defining a "scope". The "scope" may be: home, business, mobile number personal, mobile number business, personal number...

Further embodiments of the invention are now described by hand of fig. 2.

Fig. 2 shows the communication networks 1 and 2, the terminals 5, 61, 62 and 63, and the subscribers 91 and 92.

The communication network 1 is constituted by a communication network as described according to fig. 2. The communication network 1 comprises several exchanges. Fig. 2 shows the exchanges 13 and 14 and an exchange 17 with the call handling function 18.

The terminal 5 is a mobile phone, but it is also possible that the terminal 5 is a telephone set for a fixed network, for example an ISDN terminal.

In principle, the terminal 5 may be configured as the terminal 4 of fig. 1.

From functional point of view, the terminal 5 comprises input and output means 51 and functional elements 52 and 54.

The input/and output means may be formed by the input/and output means 41 of fig. 1 and offers a user interface 87 to the subscriber 91.

The function element 54 is configured as the function element 44 of fig. 1.

But, it is not necessary that the function element 54 offers the API 40. Further, it is possible that the function element 54 does only communicate via an interface 57 with the input/output means 51, which means that it is only controllable by the subscriber 91.

The function element 52 is formed by the functional element 42 of fig. 1. But, it is also possible that it has a much more simple functionality, for example does not provide the function platform 45.

The server 15 of the communication network 1 is formed by one or several interconnected computers and a plurality of software programs executed by these computers. From functional point of view, the server 15 provides at least one mediation function element to terminals of the communication network 1. For example, fig. 2 shows a mediation function element 16.

The mediation function element 16 receives requests from calling subscribers; each request transmits at least one identification of a called subscriber from a subscriber terminal to the mediation function element 16.

For example, the function element 52 of the terminal 5 contacts the mediation function element 16 over a GPRS connection or over any other kind of packet based data connection. Further, it is possible that the terminal 5 contacts the function element 16 over any other kind of connection capable to transport data packets.

The mediation function element 16 receives a request from the function element 52 which comprises an identification of a called subscriber, for example an hyperlink, the address, the name etc. of the subscriber.

The mediation function element 16 contacts an associated address translation server. If it receives a SIP-based identification, it contacts a SIP E.164 directory server.

For example, it establishes a connection 86 to the server 7, transmits the identification of the called subscriber to the server 7 and receives from the server 7 the E.164 number of the terminal 92. As already mentioned in conjunction with fig. 1, it is also possible that the mediation function element 16 exchanges further information with the terminal 5 to select one of several contacts received from the server 7. This embodiment of fig. 1 may be fully applied on this kind of architecture.

Then, the mediation function element 16 initiates the establishment of a call between the terminal 5 and the subscriber terminal of the communication network 1, which is specified by the received circuit switched network address. It transfers the received circuit switched network address to the call handling function 18 and requests a call establishment between the terminal 5 and the terminal addressed by this circuit switched network address.

For example, the mediation function element 16 sends a corresponding command message over an IN-interface or via any other kind of call control protocol (e. g. SIP via signaling gateway) to the exchange 17.

Further, the server 15 may perform an authorization of terminals (for example by help of the already existing authorization procedures within mobile telecommunication networks) and a routing of received messages to associated mediation function element.